



[7590-01-P]

## NUCLEAR REGULATORY COMMISSION

[Docket No. 50-288; NRC-2011-0172]

### Environmental Assessment and Finding of No Significant Impact

#### for License Renewal for the

#### Reed College/Reed College Research Reactor

**AGENCY:** Nuclear Regulatory Commission.

**ACTION:** Notice of Availability.

**FOR FURTHER INFORMATION CONTACT:** Geoffrey Wertz, Project Manager, Research and Test Reactor Licensing Branch, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation, U.S. Nuclear Regulatory Commission, Washington, DC 20555. Telephone: 301-415-0893; e-mail: [Geoffrey.wertz@nrc.gov](mailto:Geoffrey.wertz@nrc.gov).

## SUPPLEMENTARY INFORMATION

### I. Introduction

The U. S. Nuclear Regulatory Commission (NRC or the Commission) is considering issuance of a renewed Facility Operating License No. R-112, to be held by Reed College (the licensee), which would authorize continued operation of the Reed Research Reactor (the facility), located in Portland, Multnomah County, Oregon. Therefore, as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Section 51.21, the NRC is issuing this Environmental

Assessment and Finding of No Significant Impact. The renewal license will be issued following the publication of this notice.

## **II. EA Summary**

### Identification of the Proposed Action:

The proposed action would renew Facility Operating License No. R-112 for a period of 20 years from the date of issuance of the renewed license. The proposed action is in accordance with the licensee's application dated August 29, 2007, as supplemented by letters dated January 26, July 30, October 15, 2010, and May 20, August 3, December 12, 2011, and January 27, 2012. In accordance with 10 CFR 2.109, because the renewal application was timely filed, the existing license remains in effect until the NRC takes final action on the renewal application.

### Need for the Proposed Action:

The proposed action is needed to allow the continued operation of the Reed Research Reactor to routinely provide teaching, research, and services to numerous institutions for a period of 20 years.

### Environmental Impacts of the Proposed Action:

The NRC has completed its safety evaluation of the proposed action to issue a renewed Facility Operating License No. R-112 to allow continued operation of the Reed Research Reactor for a period of 20 years and concludes there is reasonable assurance that the reactor will continue to operate safely for the additional period of time. The details of the NRC staff's safety evaluation will be provided with the renewed license that will be issued as part of the

letter to the licensee approving its license renewal application. This document contains the environmental assessment of the proposed action.

The Reed Research Reactor is located on the eastern side of the main campus of Reed College, which is situated on approximately 100 acres of land in southeastern Portland, Oregon. The Reed Research Reactor serves about 1,300 students. The Reed Research Reactor is housed in a section of the Psychology Building constructed specifically for that purpose. The section of the Psychology building housing the Reed Research Reactor serves as a confinement and is primarily constructed of concrete, brick, and steel. The operations boundary of the Reed Research Reactor encompasses the reactor room and control room. The site boundary encompasses the entire Psychology Building and all areas 76 meters (250 feet) from the center of the reactor pool, including the Psychology and Chemistry Buildings. The nearest permanent residences are about 215 meters (700 feet) from the reactor, located in both the northeast and south directions. Reed College dormitories, housing approximately 30 students from August to May, are located approximately 150 meters (500 feet) south the reactor.

The Reed Research Reactor is a pool-type, light water moderated and cooled research reactor licensed to operate at a steady-state power level of 250 kilowatts (thermal) (kW(t)). The Reed Research Reactor is a non-pulsing reactor. The reactor core is located at the bottom of an in-ground aluminum tank which is 3 meters (10 feet) wide and 4.6 meters (15 feet) long with a 1.5 meter (5 foot) radius at each end. The tank is 7.6 meters (25 feet) deep and is bolted at the bottom to a 0.6 meter (24 inch) thick poured concrete slab. The aluminum tank is surrounded by approximately 0.76 meters (2.5 feet) of concrete. The aluminum tank is filled with demineralized water to a depth of 7.5 meters (24.5 feet), providing approximately 6 meters (20 feet) of shielding water above the top of the core.

The reactor was originally fueled and operated with both aluminum and stainless steel clad heterogeneous fuel elements consisting of nominally 20% enriched uranium-235 in a

zirconium hydride matrix. In February 2011, the aluminum clad fuel in the reactor was replaced with stainless steel clad fuel exclusively provided by the University of Arizona, resulting in a core composed of all stainless steel clad fuel elements. The aluminum clad fuel was subsequently permanently removed from the facility. Many years of experience with operating Training Research and Isotope production General Atomic (TRIGA) reactors has shown that stainless steel clad fuel provides better resistance against potential cladding failure, and is thus less susceptible to leaking radionuclides into the reactor pool and environment. A detailed description of the changes in the reactor as a result of the replacement of the aluminum clad fuel with stainless steel clad fuel is provided in the NRC staff's Safety Evaluation Report accompanying the license renewal. The 250 kW(t) core consists typically of about 87 TRIGA fuel elements positioned between a top and bottom grid plate. The reactor core is in the form of a right circular cylinder of about 23 centimeter (9 inch) radius and 38 centimeter (15 inch) length, positioned with axis vertical on one focus of a 3 meter (10 foot) by 4.6 meter (15 foot) tank with a 1.5 meter (5 foot) radius on each long end. Criticality is controlled and shutdown margin assured by 3 control rods in the form of aluminum or stainless-steel clad boron carbide or borated graphite. The control rods are guided by guide tubes that are inserted through the top grid plate and attached to the bottom grid plate by means of a special locking device. The core is cooled by natural convection of the water that occupies about one-third of the core volume.

The licensee has not requested any other changes to the facility design or operating conditions as part of the application for license renewal. No changes are being made in the types or quantities of effluents that may be released off site. The licensee has systems in place for controlling the release of radiological effluents and implements a radiation protection program to monitor personnel exposures and releases of radioactive effluents. As discussed in the NRC staff's safety evaluation, the systems and radiation protection program are appropriate

for the types and quantities of effluents expected to be generated by continued operation of the reactor. Accordingly, there would be no increase in routine occupational or public radiation exposure as a result of license renewal. As discussed in the NRC staff's safety evaluation, the proposed action will not significantly increase the probability or consequences of accidents. Therefore, license renewal would not change the environmental impact of facility operation. The NRC staff evaluated information contained in the licensee's application and data reported to the NRC by the licensee in annual reports for the last several years of operation to determine the projected radiological impact of the facility on the environment during the period of the renewed license. The NRC staff found that releases of radioactive material and personnel exposures were all well within applicable regulatory limits. Based on this evaluation, the NRC staff concluded that continued operation of the reactor would not have a significant environmental impact.

#### A. Radiological Impact

##### Environmental Effects of Reactor Operations:

Gaseous radioactive effluents are discharged by the facility exhaust system via vents located approximately 3.6 meters (12 feet) above grade, at a volumetric flow rate of approximately 37.6 cubic meters per minute (1330 cubic feet per minute). Other release pathways do exist; however, they are normally secured during reactor operation and have insignificant volumetric flow rates compared to the facility exhaust system. The only significant nuclide found in the gaseous effluent stream is argon-41. The licensee performed measurements of argon-41 production for normal conditions of reactor operation. Licensee calculations and analysis, based on those measurements, indicate that annual argon-41 releases result in an offsite concentration well below the limit of  $1.0\text{E-}8$  microCuries per milliliter ( $3.7\text{E-}10$  megaBequerels per milliliter) specified in 10 CFR Part 20, Appendix B for air effluent

releases. The NRC staff reviewed the licensee's calculations and analysis and found them to be reasonable. The licensee also performed measurements and calculations to estimate the potential of tritium in the reactor pool water. The licensee determined that tritium is not a concern for the Reed Research Reactor. The NRC staff reviewed the licensee's analysis and found it to be reasonable. Total gaseous radioactive releases reported to the NRC in the licensee's annual reports were less than one percent of the air effluent concentration limits set by 10 CFR Part 20, Appendix B. The potential radiation dose to a member of the general public resulting from this concentration is approximately 0.3 millirem (0.003 milliSieverts (mSv)) and this demonstrates compliance with the dose limit of 100 millirem (1 mSv) set by 10 CFR 20.1301. Additionally, this potential radiation dose demonstrates compliance with the air emissions dose constraint of 10 millirem (0.1 mSv) specified in 10 CFR 20.1101(d).

The licensee maintains a policy to not release any liquid radioactive waste as an effluent. Small liquid samples and any small amount of liquid generated from activities such as minor decontamination are disposed by combining with absorbents and treating as solid waste. During the past 5 years, the licensee reported no releases of liquid radioactive waste from the Reed Research Reactor.

The licensee oversees the handling of solid low-level radioactive waste generated at the Reed Research Reactor. The bulk of the waste consists of small items such as gloves, paper, plastic and small pieces of metal. The licensee disposes of the waste by decay-in-storage or shipment to a low level waste broker in accordance with all applicable regulations for transportation of radioactive materials. To comply with the Nuclear Waste Policy Act of 1982, the licensee has entered into a contract with the U. S. Department of Energy (DOE) that provides that DOE retains title to the fuel utilized at the Reed Research Reactor and that DOE is obligated to take the fuel from the site for final disposition.

As described in Chapter 11 of the Reed Research Reactor SAR, personnel exposures are well within the limits set by 10 CFR 20.1201 and are as low as is reasonably achievable (ALARA). The licensee tracks exposures of personnel monitored with dosimeters, which are usually much less than 10 percent of the occupational limit of 5,000 millirem (50 mSv) per year. Area thermo-luminescent dosimeter (TLD) monitors mounted in the control room and other strategic locations provide an additional quarterly measurement of total radiation exposures at those locations. These TLDs typically report less than 200 millirem (2.0 mSv) total over a one year period. No changes in reactor operation that would lead to an increase in occupational dose are expected as a result of the proposed action.

The licensee conducts an environmental monitoring program to record and track the radiological impact of the Reed Research Reactor operation on the surrounding unrestricted area. The program consists of continuous area monitors in the facility and periodic surveys in and around the facility. The licensee administers the program and maintains the appropriate records. Over the past five years, the survey program indicated that radiation exposures at the monitoring locations were not significantly higher than those measured at the control locations. Year-to-year trends in exposures are consistent between monitoring locations. Also, no correlation exists between total annual reactor operation and annual exposures measured at the monitoring locations. Based on its review of the past several of data as provided in the licensee's annual reports, the NRC staff concludes that operation of the Reed Research Reactor does not have any significant radiological impact on the surrounding environment. No changes in reactor operation that would affect off-site radiation levels are expected as a result of the proposed action.

### Environmental Effects of Accidents:

Accident scenarios are discussed in Chapter 13 of the Reed Research Reactor SAR as supplemented in responses to Requests for Additional Information. The maximum hypothetical accident is the cladding rupture of one highly irradiated fuel element with no radioactive decay followed by the instantaneous release of the noble gas and halogen fission products into the air of the reactor room. The licensee conservatively calculated doses to facility personnel and the maximum potential dose to a member of the public. The NRC staff checked the licensee's calculations to verify that the doses represent conservative estimates for the maximum hypothetical accident. Occupational doses resulting from this accident would be well below the 10 CFR Part 20 annual limit of 5,000 mrem (50 mSv). Maximum doses for members of the public resulting from this accident would be well below the 10 CFR Part 20 annual limit of 100 mrem (1.0 mSv). The proposed action will not increase the probability or consequences of accidents.

### B. Non-Radiological Impacts

The Reed Research Reactor core is cooled by a light water primary system consisting of the reactor pool, a heat removal system, and a filter and demineralizer water processing system. Cooling occurs by natural convection, with the heated coolant rising out of the core and into the bulk pool water. The large heat sink provided by the volume of primary coolant, approximately 95,000 liters (25,000 gallons) of water, allows several hours of full-power operation without any secondary cooling. The heat removal system transfers heat to the secondary system via a centrifugal pump, heat exchanger and a cooling tower. Both the primary and secondary system use make-up water filtered from the municipal water system. Precautions are taken with the secondary system to prevent biological growth and freezing.

During operation, the secondary system is maintained at a higher pressure than the primary system to minimize the likelihood of primary system contamination entering the secondary system, and ultimately the environment. The licensee monitors both systems for purity and to detect leakage.

Given that the proposed action does not involve any change in the operation of the reactor and the heat load dissipated to the environment, the NRC staff concludes that the proposed action will not have a significant impact on the local water supply.

#### National Environmental Policy Act (NEPA) Considerations:

The NRC has responsibilities that are derived from NEPA and from other environmental laws, which include the Endangered Species Act (ESA), Coastal Zone Management Act (CZMA), National Historic Preservation Act (NHPA), Fish and Wildlife Coordination Act (FWCA), and Executive Order 12898 Environmental Justice. The following presents a brief discussion of impacts associated with these laws and other requirements.

##### 1. Endangered Species Act

Federally- or State-listed protected species have not been found in the immediate vicinity of the Reed Research Reactor, and effluents and emissions from the reactor have not had an impact on critical habitat.

##### 2. Coastal Zone Management Act

The Reed Research Reactor is not located within any managed coastal zones, nor would the effluents and emissions from the reactor impact any managed coastal zones.

##### 3. National Historic Preservation Act

The National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties. The National Register of Historic Places (NRHP) lists several historical sites in Multnomah County. However, none of the sites are within

the general vicinity of the Reed Research Reactor site and, given its location, continued operations of the reactor will not impact any historical sites. The NRC contacted the State Historical Preservation Officer (SHPO) in Oregon and discussed the proposed action. The SHPO concurred that there are no historic properties affected by this action. Based on this information, the NRC finds that the potential impacts of the proposed action would have no adverse effect on historic and archaeological resources in the vicinity of the reactor.

4. Fish and Wildlife Coordination Act

The licensee is not planning any water resource development projects, including any modifications involving impounding a body of water, damming, diverting a stream or river, deepening a channel, irrigation, or altering a body of water for navigation or drainage.

5. Executive Order 12898 – Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the relicensing and the continued operation of the Reed Research Reactor. Such effects may include human health, biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the reactor and all are exposed to the same health and environmental effects generated from activities at the reactor.

Minority Populations in the Vicinity of the Reed Research Reactor – According to 2010 census data, 25.5 percent of the total population (approximately 276,157 individuals) residing within a 10-mile radius of the reactor facility identified themselves as minority individuals. The largest minority groups were Hispanic or Latino (of any race) (112,079 persons or 10.3 percent), followed by Asian (70,117 or 6.5 percent). According to U.S. Census Bureau 2010 estimates, about 27.9 percent of the Multnomah County population identified themselves as minorities, with

persons of Hispanic or Latino origin comprising the largest minority group (10.9 percent), followed by Asian (6.8 percent) and Black or African American (5.8 percent).

Low-income Populations in the Vicinity of the Reed Research Reactor – According to 2010 Census data, an average of 8.8 percent of families and 12.5 percent of individuals residing within counties in a 10 mile radius of the reactor (Clackamas, Multnomah, and Washington Counties, Oregon, and Clark County, Washington), were identified as living below the Federal poverty threshold in 2010. The 2010 Federal poverty threshold was \$22,314 for a family of four.

According to American Community Survey Census data estimates for 2010, the median household income for Oregon was \$46,560, while 11 percent of families and 15.8 percent of the state population were determined to be living below the Federal poverty threshold. Multnomah County had a higher median household income average (\$48,043) and a higher percent of families (13.6 percent) and individuals (18.2 percent) living below the poverty level, respectively.

Impact Analysis—Potential impacts to minority and low-income populations would mostly consist of radiological effects, however radiation doses from continued operations associated with the license renewal are expected to continue at current levels, and would be well below regulatory limits.

Based on this information and the analysis of human health and environmental impacts presented in this environmental assessment, the proposed relicensing would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations residing in the vicinity of the Reed Research Reactor.

#### Environmental Impacts of the Alternatives to the Proposed Action:

As an alternative to license renewal, the NRC considered denying the proposed action. If the NRC denied the request for license renewal, reactor operations at the facility would cease and decommissioning would be required. The NRC notes that, even with a renewed license,

the Reed Research Reactor will eventually be decommissioned, at which time the environmental effects of decommissioning would occur. Decommissioning would be conducted in accordance with an NRC-approved decommissioning plan which would require a separate environmental review under 10 CFR 51.21. Cessation of reactor operations at the Reed Research Reactor would reduce or eliminate radioactive effluents and emissions. However, as previously discussed in this environmental assessment, radioactive effluents and emissions from reactor operations constitute a small fraction of the applicable regulatory limits. Therefore, the environmental impacts of renewing the license and the denial of the request for license renewal would be similar. In addition, denying the request for license renewal would eliminate the benefits of teaching, research, and services provided by the Reed Research Reactor.

Alternative Use of Resources:

The proposed action does not involve the use of any different resources or significant quantities of resources beyond those previously considered in the issuance of Amendment No. 8 to Facility Operating License No. R-112 for the Reed Research Reactor dated January 4, 2011, which increased the possession limit of special nuclear material and by-product material allowed to be received, possessed and used in the Reed Research Reactor.

Agencies and Persons Consulted:

In accordance with the agency's stated policy, on January 25, 2011, the NRC staff consulted with the Oregon State Liaison Officer regarding the environmental impact of the proposed actions. The consultation involved a thorough explanation of the environmental review, the details of this environmental assessment, and the NRC staff's findings. The State official indicated that the State had no issues or concerns with this action, that he understood the NRC review and had no comments regarding the proposed action.

Finding of No Significant Impact:

On the basis of the environmental assessment, the NRC concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC has determined not to prepare an environmental impact statement for the proposed actions.

**III. Further Information**

Documents related to this action, including the application for license renewal and supporting documentation, are available online in the NRC Library at <http://www.nrc.gov/reading-rm/adams.html>. From this page, the public can gain entry into (ADAMS), which provides text and image files of the NRC's public documents. The application for license renewal, dated August 29, 2007 as supplemented by letters dated January 26, July 30, October 15, 2010, and May 20, August 3, December 12, 2011, and January 27, 2012, is available electronically under ADAMS Accession Nos. ML092310567, ML100610121, ML102360016, ML102990489, ML111520559, ML11222A026, ML113630145, and ML12039A147. Also see the license's annual reports for years 2003-2004 (ADAMS Accession No. ML043620310), 2004-2005 (ADAMS Accession No. ML052930194), 2005-2006 (ADAMS Accession No. ML062850518), 2006-2007 (ADAMS Accession No. ML073040191), 2007-2008 (ADAMS Accession No. ML082890533), 2008-2009 (ADAMS Accession No. ML092720865), 2009-2010 (ADAMS Accession No. ML102440042), and 2010-2011 (ADAMS Accession No. ML11221A161). If you do not have access to ADAMS or if there are problems in accessing the documents located in ADAMS, contact the NRC's PDR reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to [pdr.resource@nrc.gov](mailto:pdr.resource@nrc.gov). These documents may also be viewed electronically on the public computers located at the NRC's PDR, O 1 F21, One White Flint

North, 11555 Rockville Pike (first floor), Rockville, MD 20852. The PDR reproduction contractor will copy documents for a fee.

Dated at Rockville, Maryland, this 21<sup>st</sup> day of March, 2012.

FOR THE NUCLEAR REGULATORY COMMISSION

**/RA/**

Jessie F. Quichocho, Chief  
Research and Test Reactors Licensing Branch  
Division of Policy and Rulemaking  
Office of Nuclear Reactor Regulation

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